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Ishikawa

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[54] **LUBRICATING SYSTEM FOR AN INTERNAL COMBUSTION ENGINE**

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Dec. 25, 1986 [JP] Japan ..... 61-201936[U]

[51] **Int. Cl.**[4] **F01M 1/00**
[52] **U.S. Cl.** ..... **123/196 R;** 123/192 B; 184/6.5
[58] **Field of Search** ..... 123/196 R, 192 R, 192 B; 184/6.5

[56] **References Cited**

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Attorney, Agent, or Firm—Martin A. Farber

[57] **ABSTRACT**

A cover is secured to a crankcase of an engine to form a part of the crankcase. The crankshaft is supported by bearings provided in the cover and the crankcase. An oil passage is provided in the crankcase and cover and extending from an opening at a bottom of the crankcase to an inlet of an oil pump. Further, oil passages are provided in the cover and crankshaft extending from an outlet of oil pump to openings which open to the bearings for the crankshaft.

4 Claims, 6 Drawing Sheets

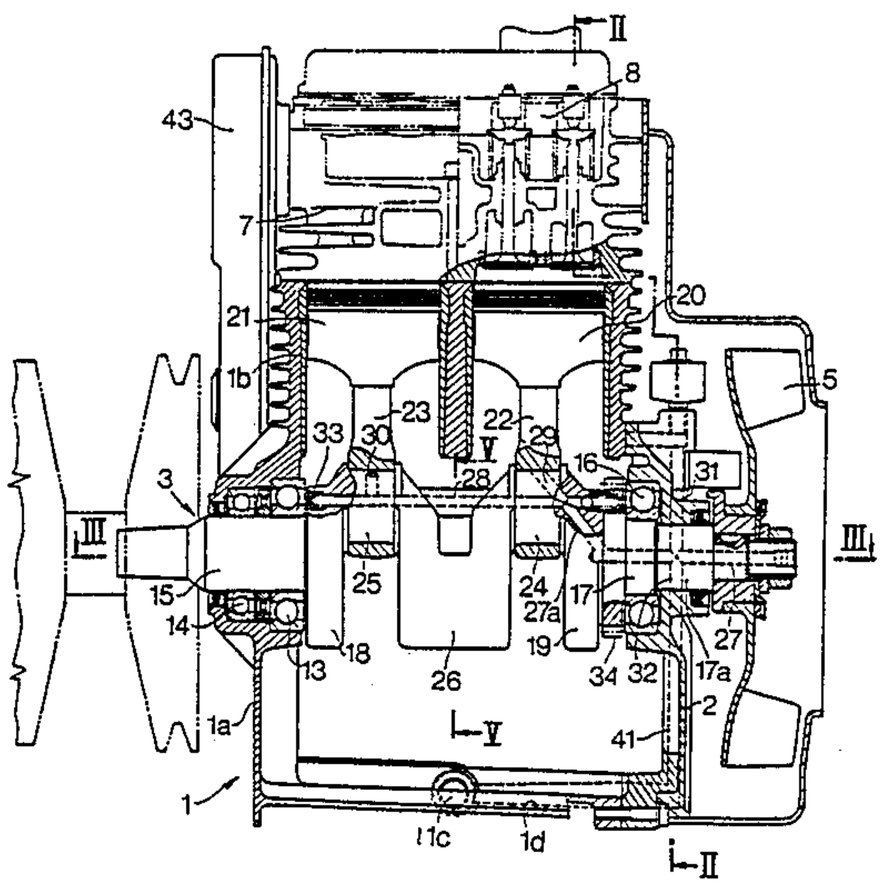
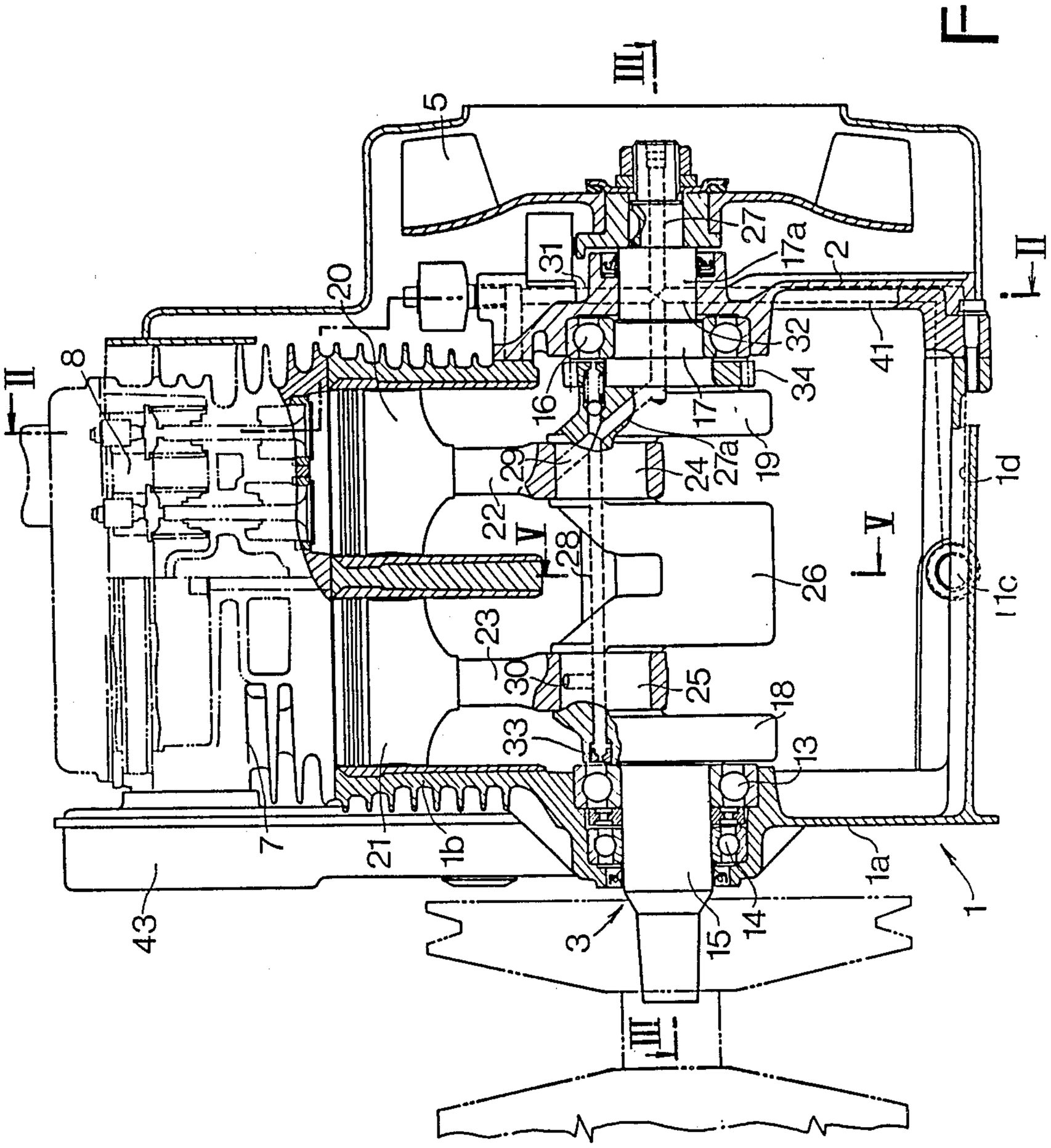


FIG. 1


III
5
27
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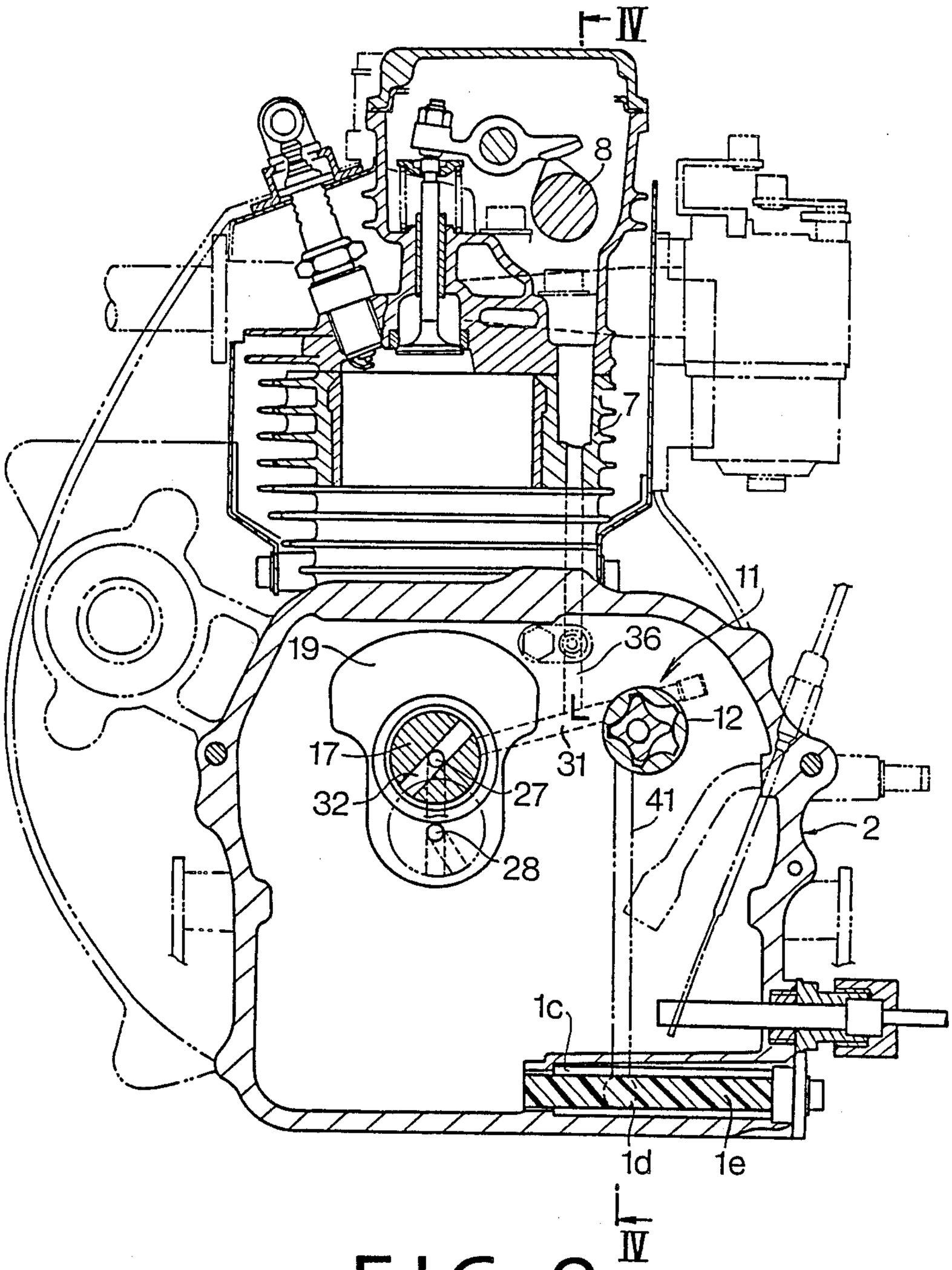

FIG. 2

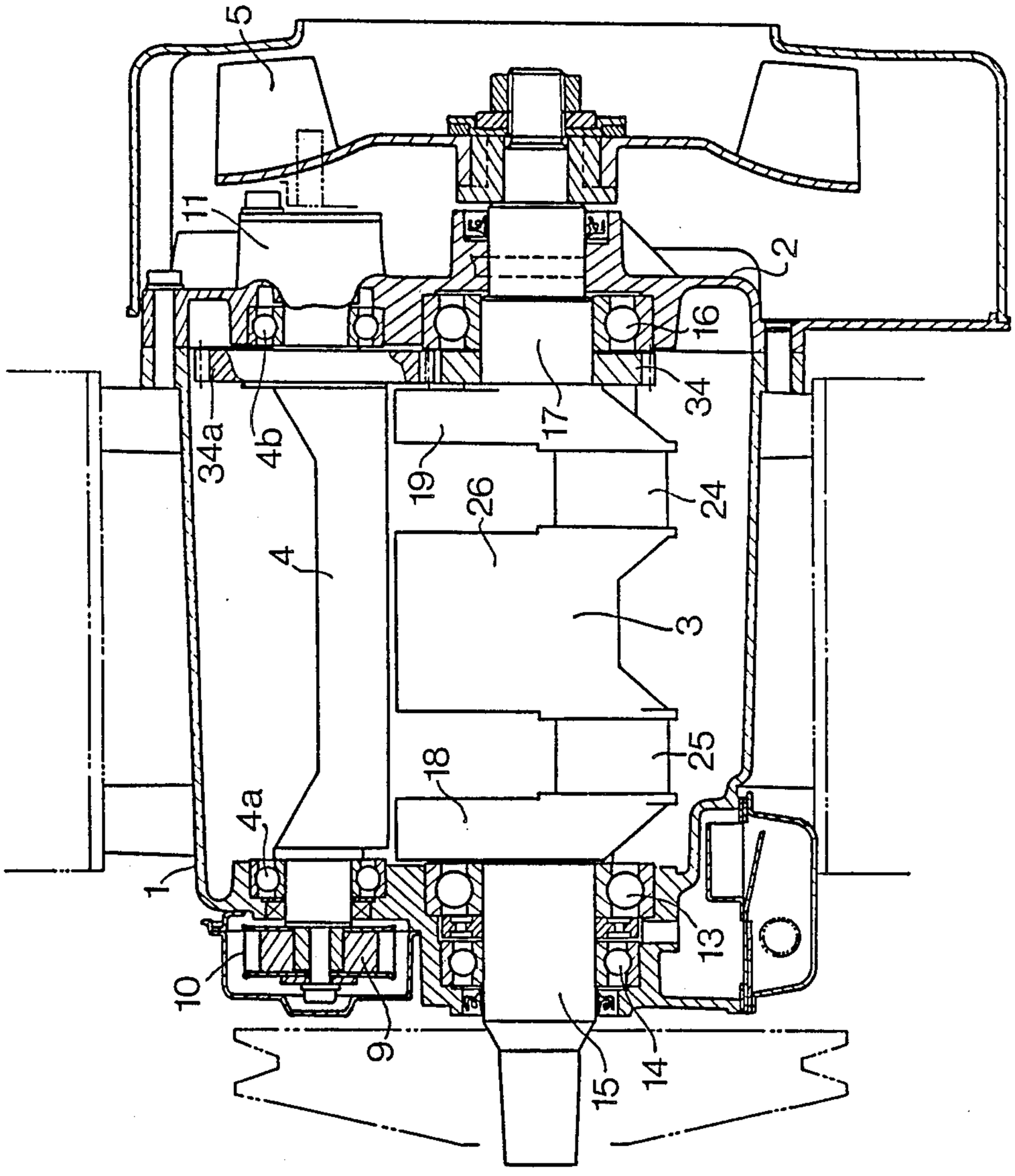

FIG. 3

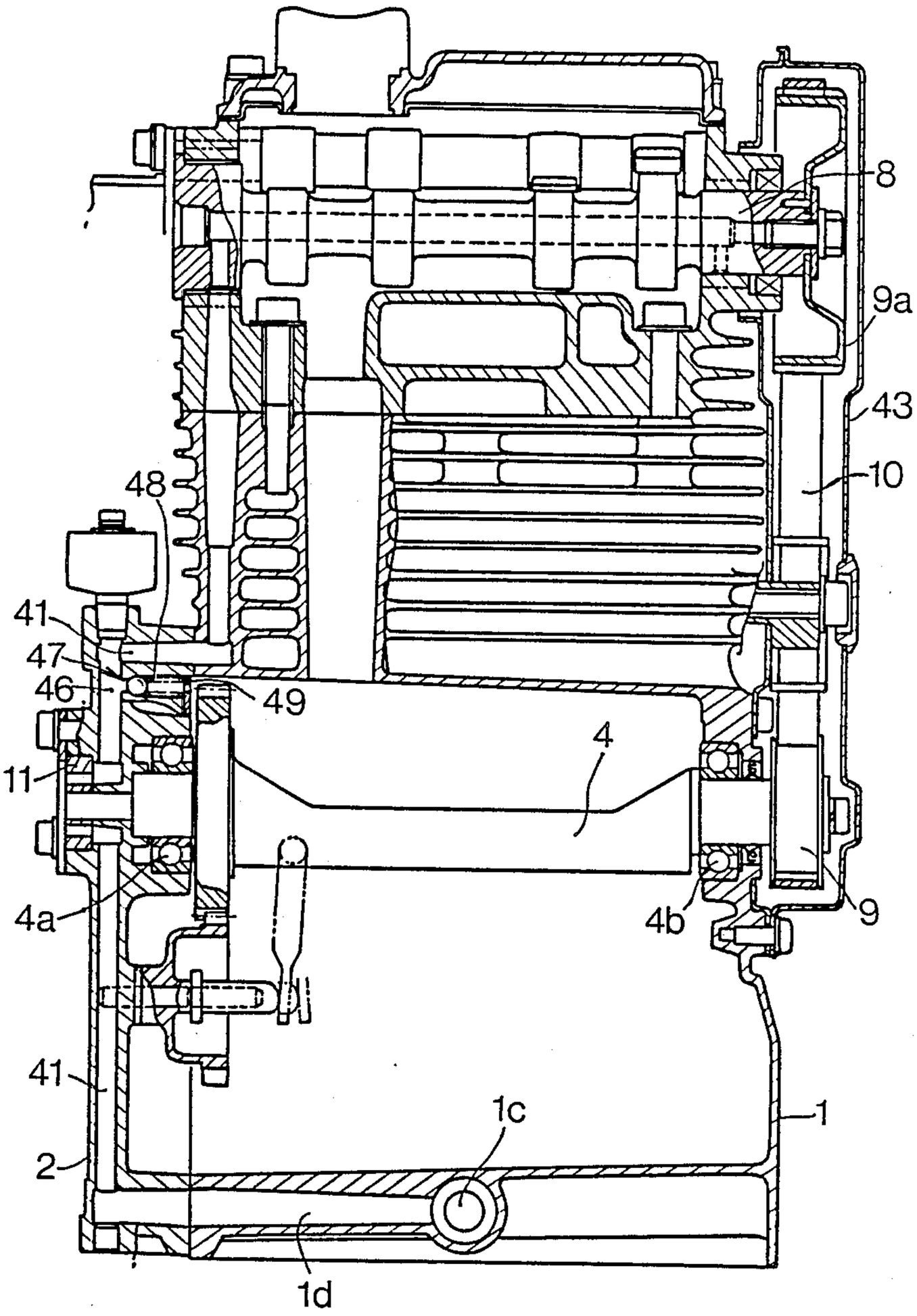

FIG. 4

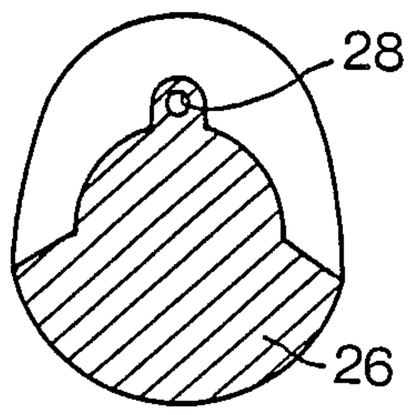

FIG. 5

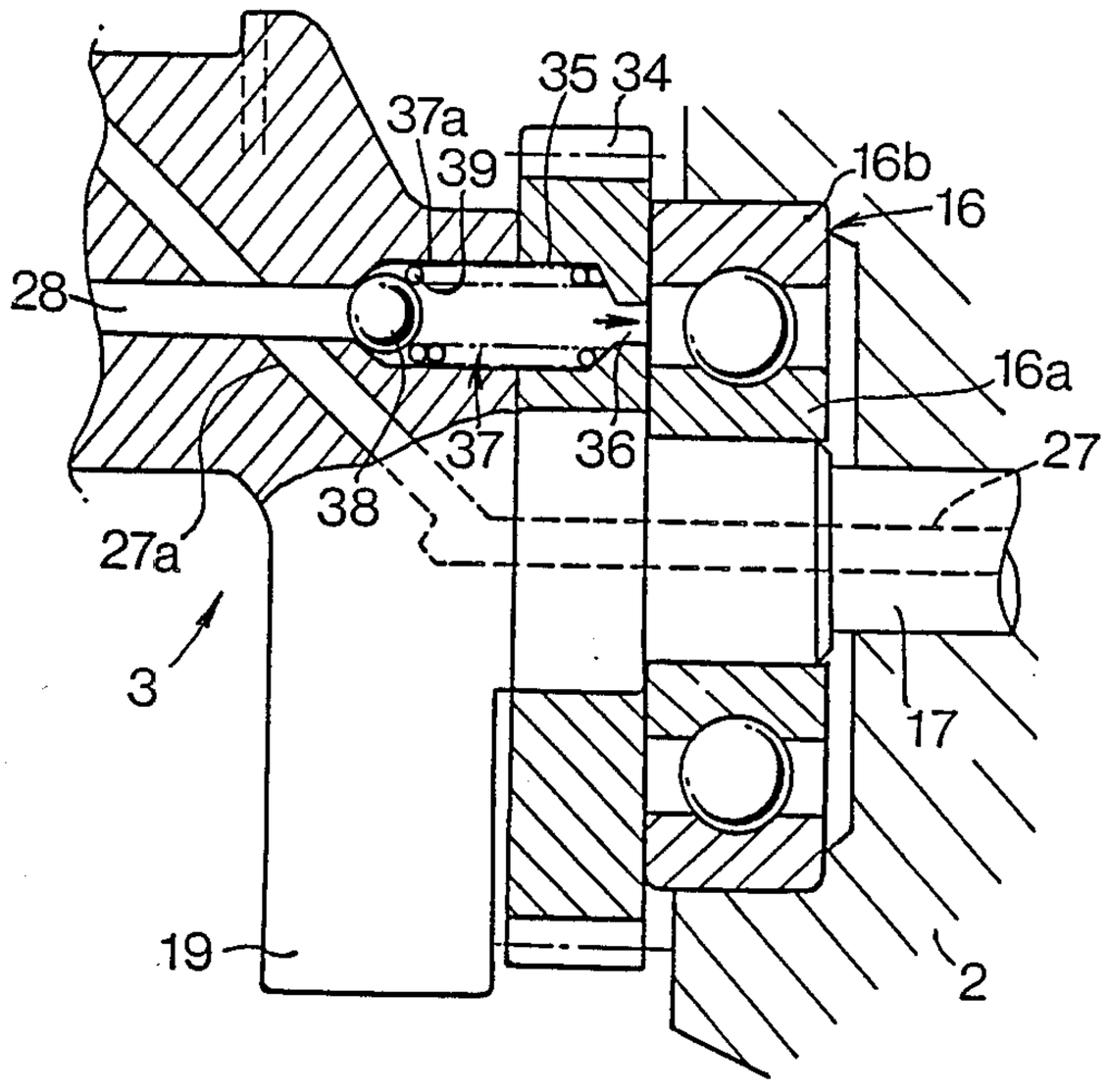

FIG. 6

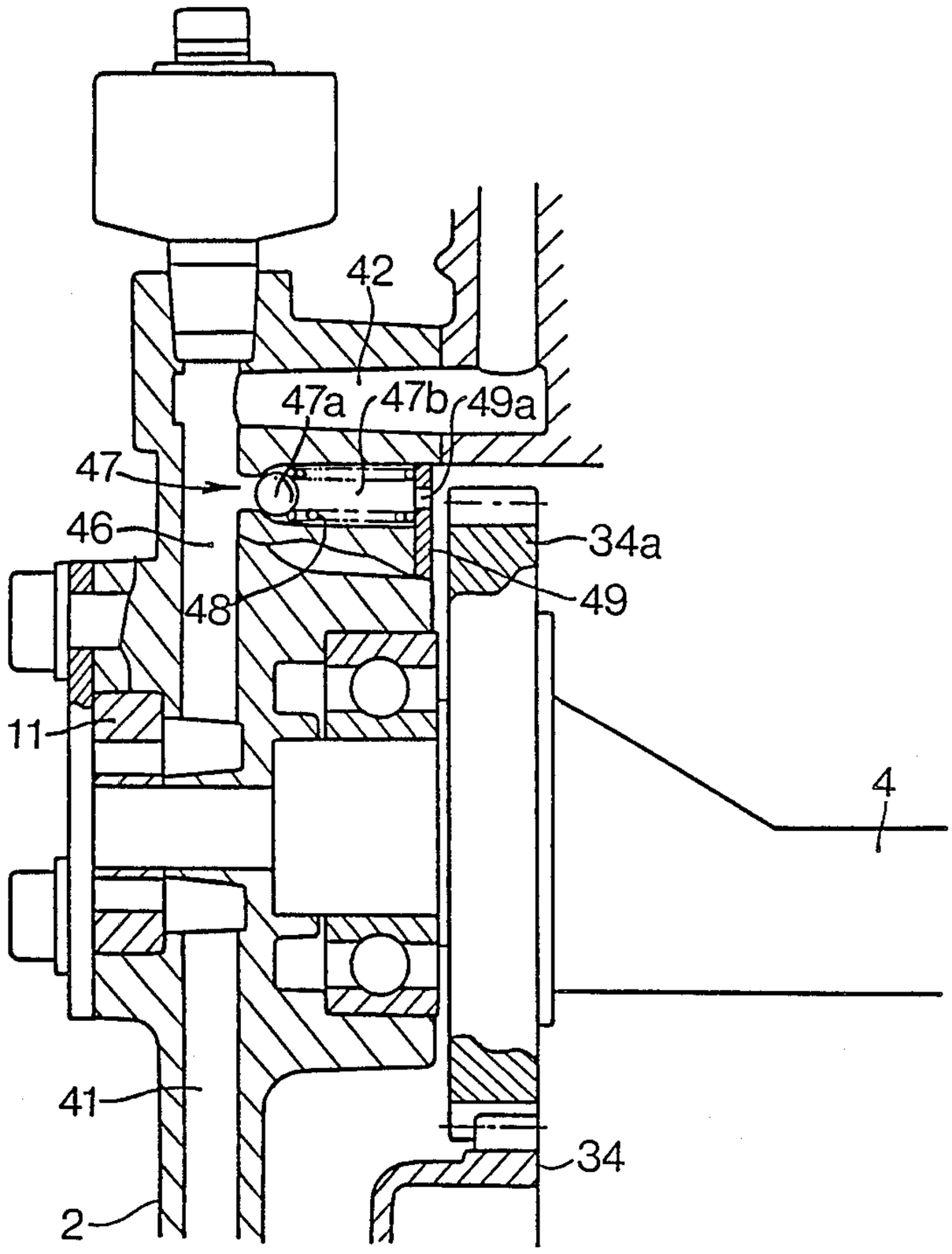

FIG. 7

LUBRICATING SYSTEM FOR AN INTERNAL COMBUSTION ENGINE

BACKGROUND OF THE INVENTION

The present invention relates to a lubricating system for an internal combustion engine, and more particularly to a system for lubricating bearings of a crankshaft of the engine.

Japanese Utility Model Publication No. 60-42161 discloses a lubricating system for bearings of a crankshaft in which an oil passage is provided passing in the crankshaft and a crankpin and oil is ejected in a direction parallel with axis of the crankshaft and sprayed onto a side of each bearing. In such a system, a complicated oil passage must be provided for supplying lubricating oil to the passage in the crankshaft.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a lubricating system in which an oil passage for supplying oil to bearings may be simplified in construction.

In accordance with the present invention, the lubricating system is characterized in that an oil passage is formed in a cover which is provided as a part of a crankcase, thereby simplifying the construction of the oil passage.

According to the present invention, there is provided a lubricating system for an internal combustion engine having at least one cylinder, crankcase, a crankshaft, a balancer shaft rotated by the crankshaft through gears, and an oil pump.

The system comprises a cover secured to the crankcase to form a part of the crankcase, the crankshaft being supported by a first bearing provided in the cover and by a second bearing provided in the crankcase, a first oil passage provided in the crankcase and cover and extending from an opening at a bottom of the crankcase to an inlet of the oil pump, a second oil passage provided in the cover and extending from an outlet of the oil pump to a first opening which opens to a journal of the crankshaft, a third oil passage provided in the crankshaft and extending from a second opening corresponding to the first opening to third openings which open to the first and second bearings and to connecting rods at crankpins of the crankshaft.

In an aspect of the invention, a fourth oil passage is provided in the cover and extending from the outlet of the oil pump to a fourth opening which opens to the gears on the balancer shaft, and a check valve is provided in the third oil passage adjacent the nozzle for the first bearing.

The other objects and features of this invention will be apparently understood from the following description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a sectional view of an aircooled engine to which the present invention is applied;

FIG. **2** is a sectional view taken along a line II—II of FIG. **1**;

FIG. **3** is a sectional view taken along a line III—III of FIG. **1**;

FIG. **4** is a sectional view taken along a line IV—IV of FIG. **2**;

FIG. **5** is a sectional view taken along a line V—V of FIG. **1**;

FIG. **6** is an enlarged view of a part of FIG. **1**; and

FIG. **7** is an enlarged view of a part of FIG. **4**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, an aircooled, two-cylinder engine has a case body **1** comprising a crankcase **1***a* and a pair of cylinders **1***b* integral with the crankcase **1***a*, and a cover **2** serves as a part of the crankcase **1***a*. A crankshaft **3** is supported by the crankcase **1***a* and the cover **2** through a main bearing **13**, sub-bearing **14** and main bearing **16**, respectively. Secured to one end of the crankshaft **3** is a pulley for transmitting engine power and securely mounted on the other is a cooling fan **5** made of synthetic resin for producing air current.

The crankshaft **3** has a journal **15** supported by bearings **13**, **14**, a journal **17** supported by bearing **16**, webs **18**, **19** adjacent the journals **15**, **17**, first and second crank pins **24**, **25** for connecting rods **22**, **23** of first and second pistons **20**, **21**, and a web **26** between crankpins **24**, **25**.

As shown in FIGS. **3** and **4**, a balancer shaft **4** is supported by bearings **4***a* and **4***b* provided in the crankcase **1***a* and the cover **2**. A drive gear **34** (FIG. **1**), which is securely mounted on the crankshaft **3** between the main bearing **16** and the web **19**, meshes with a driven gear **34***a* securely mounted on the balancer shaft **4** so as to rotate the balancer shaft **4**. The balancer shaft **4** is connected to a camshaft **8** mounted in a cylinder head **7** through a drive pulley **9** disposed at the opposite end of the balancer shaft **4** to the gear **34***a*, driven pulley **9***a* at an end of the camshaft **8**, and a timing belt **10** running on the pulleys (FIG. **4**). The pulleys **8**, **9** and timing belt **10** are covered by a belt cover **43**.

Referring to FIGS. **2**, **3** and **4**, a rotor **12** of an oil pump **11** is secured to the end of the balancer shaft **4** adjacent the gear **34***a*.

A first oil gallery **27** is formed in the journal **17** and an oblique passage **27***a* communicated with the oil gallery **27** is formed in the web **19** and crankpin **24** and opened to a big-end of the connecting rod **22** at an opening **29**. A second oil gallery **28** is provided extending in the web **19**, crankpin **24**, web **26**, crankpin **25** and web **18**. The second oil gallery **28** intersects and intercommunicates with the oblique passage **27***a*. The second oil gallery **28** opens to a big-end of the connecting rod **23** at an opening **30** in the crankpin **25**.

As shown in FIG. **6**, a large diameter passage **37***a* is formed in the web **19** to communicate with the second oil gallery **28** and extended into the gear **34**. A ball **38** is urged by a spring **39** to close the open end of the oil gallery **28**, thereby forming a check valve **37**. The passage **37***a* is communicated with a nozzle **36** which opens to a side of the bearing **16** at a space between inner and outer rings **16***a* and **16***b* thereof. As shown in FIG. **1**, at the other end of the second oil gallery **28**, a nozzle **33** is provided in the gallery to open to a side of the bearing **13** like the nozzle **36**.

Referring to FIGS. **1**, **2** and **4**, crankcase **1***a* has an oil passage **1***c* opening to oil reservoir in the crankcase and an oil passage at the bottom thereof. The cover **2** has a vertical oil passage **41** communicated with the passage **1***d* and with an inlet of the oil pump **11**. An outlet of the oil pump **11** is connected to a passage **31** formed in the cover **2** and opening to the journal **17**. In the journal **17**, a radial passage **32** communicated with the first oil gallery is provided to communicate with the passage **31** at every 180 degrees rotation of the crankshaft.

The passage **31** is further connected to a passage **46** formed in the cover **2**. As shown in FIG. **7**, the passage **46** is connected to a check valve **47** comprising a passage **47***b* formed in the cover **2**, extending in parallel with the axis of the crankshaft **3**, and a ball **47***a* urged by a spring **48**. The passage **47***b* is connected to a nozzle **49***a* formed in a plate **49** secured to the cover **2**. The nozzle **49***a* is provided to open to a side of the gear **34***a* of the balancer shaft **4** at the teeth thereof. A passage **42** connected to the passage is provided to lubricate the camshaft **8**.

In operation, when the balancer shaft **4** is rotated by the crankshaft **3**, the oil pump **11** is driven by the balancer shaft **4**. Thus, oil in the il reservoir is drawn into the oil pump **11** through the passages **1***c*, **1***d* and an oil filter le and passage **41**. The oil discharged from the oil pump passes to the second oil gallery **28** passing through passage **31** in the cover and, passage **32** and first oil gallery **27** in the journal **17**, and passage *27a*, and flows out from openings **29** and **30** to lubricate crankpins **24**, **25** and connecting rods **22**, **23**. The oil is also ejected from the nozzle to the bearing **13** to lubricate it. When pressure of oil in the second oil gallery **28** exceeds a set value, the oil passes the check valve **37** and is ejected from the nozzle **36**, thereby lubricating the bearing **16**. Further, the oil passes through the passage **46** and the check valve **47** and is ejected from the nozzle **49***a* to the gear **34***a*, so that the teeth of the gears **34***a* and **34** are lubricated. Thus, one of the check valves **37**, **47** acts also as a relief valve for the oil pump **11**.

While the presently preferred embodiment of the present invention has been shown and described, it is to be understood that this disclosure is for the purpose of illustration and that various changes and modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A lubricating system for an internal combustion engine having at least one cylinder, crankcase, a crankshaft, a balancer shaft rotated by said crankshaft through gears, and an oil pump, comprising:

a cover secured to said crankcase to form a part of the crankcase,

said crankshaft being supported by a first bearing provided in said cover and by a second bearing provided in said crankcase;

a first oil passage provided in said crankcase and cover and extending from an opening at a bottom of the crankcase to an inlet of said oil pump;

a second oil passage provided in said cover and extending from an outlet of said oil pump to a first opening which opens to a journal of said crankshaft;

a third oil passage provided in said crankshaft and extending from a second opening corresponding to said first opening to third openings which open to said first and second bearings and to connecting rods at crankpins of said crankshaft.

2. The lubricating system according to claim **1** further comprising a fourth oil passage provided in said cover and extending from said outlet of said oil pump to a fourth opening which opens to said gears on said balancer shaft.

3. The lubricating system according to claim **1** wherein said third openings includes nozzles for said first and second bearings.

4. The lubricating system according to claim **3** further comprising a check valve provided in said third oil passage adjacent said nozzle for said first bearing.

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